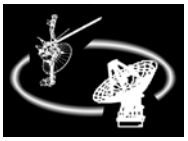

Deep Space Mission System

Quality Assurance Program Plan for DSN Hardware

Service Capability Development (SCD) Standard Practice

Supersedes 810-037

DSMS No. **813-012**
Issue Date: 19 Sept 2003
JPL D-26084

Jet Propulsion Laboratory

California Institute of Technology

Deep Space Mission System

Quality Assurance Program Plan for DSN Hardware

SCD Policies and Practices

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Document Change Log

Revision	Issue Date	Affected Sections or Pages	Change Summary
Original	19 Sept 2003	All	This document supersedes 810-037

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Section 1
Introduction

1.1 Purpose

The Jet Propulsion Laboratory (JPL) is required to establish and execute a Comprehensive Quality Assurance Program at all levels of the Deep Space Network (DSN) in accordance with the current NASA contract.

This document defines the Quality Assurance Program for the DSN in terms of quality task elements, which include quality functions and organizational responsibilities for implementation.

The contents of this document are also are an element of the Deep Space Mission System (DSMS) Quality Assurance plan for accomplishment of DSMS mission objectives and goals.

The Quality Assurance provisions set forth in this document support all areas of the DSN, which include, but are not limited to the Deep Space Communication Complexes (DSCC).

1.2 Applicability

This document establishes the required quality task elements for all hardware elements of the DSN.

Quality requirements for the DSN are effected and implemented on a continuous basis from the initial design concept through procurement, fabrication, delivery, installation, and during the acceptance phases that include monitoring by inspection personnel.

The quality provisions set forth in this document are intended to provide a consistent method by which equipment can be inspected and accepted to satisfy JPL and NASA requirements.

The requirements specified herein are in accordance with all Quality Assurance Planning and Implementation requirements, and consistent with the requirements of DSMS document 820-001, Deep Space Mission System Requirements and Design.

1.3 Applicable Documents

JPL Specifications

GMO-50139-GEN	Quality Control Requirements for Ground Support Equipment, General Specification
GMO-50190-GEN	Inspection Standards for Workmanship, Ground Support Equipment, General Specification For
ES504049	Quality Control Requirements for Cabling and Harnesses Ground Support Equipment, Detail Specification For
ES504390	Antenna Mechanical Subsystem Quality Program Provisions for the Contractors and Subcontractors, Detail Specification For
ES506015	Quality Assurance Inspection System Requirements for Electronic and Mechanical Equipment, Detail Specification For

FS505770	Solderless Wirewrap Connections for Panel & Assemblies for DSN Equipment
FS5070l7	Identification and Marking Methods for DSN Parts and Assemblies, General Specification For
FS510157	Ground Data System Requirements Hand Crimping of Electrical Connectors, Detail Specification for
FS510995	Ground Data System Requirements Hand Soldering of Electrical Connections Ground Support Equipment, Detail Specification
JPL-D-1348	JPL Standard for Electrostatic Discharge (ESD) Control

JPL Quality Sub-Tier Documents

QAP 141.10	JPL Inspection Report
QAP 144.1	QA Material Review Board Action
QAP 144.2	Control of Nonconforming Product
QAP 82.1	Inspection of DSN Engineering Change Order Kits

DSMS Requirements and Standard Practices

DSMS 820-001	Deep Space Mission System Requirements And Design
DSMS 813-011	DSMS Service Capability Development (SCD) Process Definition
DSMS 813-125	DSN Hardware Transfer and Delivery Procedures
DSMS 813-126	DSN Software Transfer and Delivery Procedures

DSN Workmanship Assurance Program Plans

DSMS 874-021	GDSCC DSN Workmanship Assurance Program Plan
DSMS 874-026	CDSCC DSN Workmanship Assurance Program Plan
DSMS 874-031	MDSCC DSN Workmanship Assurance Program Plan

Section 2
Quality Assurance Task Elements

2.1 Organization

The Quality Assurance organizational structure that supports the DSMS DSN Engineering and DSN Operations includes the task elements of: management, implementation planning, resource allocation, quality engineering, surveillance, training, inspection, nonconforming material control, and workmanship assurance.

2.1.1 Organizational Interfaces

Quality Assurance implementation involves interfaces with the following organizations:

(1) The Technical Divisions for the coordination of projects/tasks to support the implementation of electrical/mechanical systems/subsystems and technical facilities.

(2) Operations Engineering for Quality Assurance Inspection Reports related to hardware deliveries.

(3) The Deep Space Communication Complexes (DSCCs) for auditing of Workmanship Assurance (WA) program, including validation of the Quality System effectiveness at each site.

(4) Office 930 for budget and resources related to implementation of QA-provided WA activities in support of Pasadena Operations and the DSCCs.

(5) Office 940 for coordination of planning, scheduling, and funding. QA personnel are involved in coordination with the Implementation Team, including the Project/Task manager, resident QA Engineers, DSCC Engineering, Implementation Coordination Engineers (ICE), and DSCC Management for on-site implementation of Quality Assurance efforts associated with DSN assets.

2.2 Key QA Roles

2.2.1 The DSMS Quality Assurance Representative

The DSMS Quality Assurance Representative, in response to the DSMS Office, follows DSMS programmatic and fiscal guidelines in providing Quality Program planning and establishment of the requirements for all Quality Assurance activities in support of the DSMS Program. The DSMS Quality Assurance Representative is also the Office Manager of Quality Assurance, or his designee, performing duties as the Division Representative.

The DSMS Quality Assurance Representative has the responsibility and authority to accomplish the following:

(1) Implement the Quality Assurance Program at various levels (subject to DSMS review and approval). Provide guidelines for activities that affect Quality Assurance, such as DSN system/subsystem requirements reviews, design review, hardware reviews, procurement requirements, inspection during fabrication, test and final assembly, and site modifications.

(2) Establish guidelines for and approve supplier Contractor Quality Assurance Plans and requirements for approved sources.

(3) Audit the Quality Assurance Program activities, and make recommendations for further quality effectiveness to the DSMS Engineering Office (Office 940).

(4) Establish the DSN Workmanship Assurance Program (subject to DSMS review and approval). Provide the associated workmanship standards, inspection standards, training and certification of WA instructors and inspectors, procedures for WA training and certification documentation. Conduct independent technical audits of all WA activities and hardware.

(5) Attend and participate in DSMS Engineering Office staff meetings concerning quality matters relative to the DSN.

(6) Provide the required resources and direction of Quality Assurance personnel with appropriate skills to support DSN commitments in accordance with the DSMS Work Agreement document. (See http://wa.jpl.nasa.gov)

(7) Provide a Quality Assurance Task Representative for major tasks.

(8) Provide a Quality Assurance Management and Implementation Plan for each major task, such as station antenna reconfiguration QA Plan, or a Development and Deployment Plan (DDP). Provide a monthly report to the Task Manager and the DSMS Engineering (Office 940) Manager summarizing the progress of quality tasks and problems.

(9) Conduct an audit of the WA program of each DSN Complex, not less than once every 2 years. Report results to the DSMS Operations Office (Office 930).

2.2.2 Quality Assurance Engineering/Supervision

Quality Assurance engineers and supervisors (in Office 512) are assigned to the technical areas, and are responsible to the DSMS Quality Assurance Representative to support the implementation of his responsibilities. The Quality Assurance engineers are responsible for conducting quality-related activities at JPL, subcontractors, and any of the DSN facilities as necessary to ensure conformance to Project and contractual quality requirements.

2.2.3 Quality Assurance Personnel

Quality Assurance personnel assigned to support DSMS perform independent assessments of work at JPL labs, fabrication shops, vendors facilities, and at the DSCCs.

This effort includes surveys, contract negotiations, conferences, periodic audits, and inspections to support engineering projects/tasks and contractual requirements.

2.3 Implementation Task Planning Responsibilities

An essential part of the Quality Assurance Program is the identification of all quality functions by Project/task elements. Each implementation task is expected to identify the scope of the required QA support at the time of the Preliminary Definition and Cost Review (PDCR).

Quality Assurance shall work with DSMS personnel to plan, develop, and implement effective QA programs in accordance with established DSMS policy and procedures, for all major tasks, additions of new facilities, and upgrades to existing facilities.

2.4 Resources Allocation

The DSMS Quality Assurance Management Representative (or his/her designee) shall be responsible for obtaining, monitoring, and controlling the QA resources necessary for support of DSN commitments. Implementation tasks plans/budgets must include QA resources at a level appropriate to the nature of the task, and consistent with SCD task planning requirements.

2.5 Quality Engineering and Planning

2.5.1 Engineering and Planning

Quality Engineering, responsible to the DSMS Quality Assurance Representative, is responsible for quality engineering and planning to support the Project/tasks quality requirements.

This responsibility includes the development of procedures, program plans, inspection standards, quality specifications, process specifications, training/certification programs, and quality systems for DSN application and hardware transfer agreements.

2.5.2 Review of DSN Engineering Documents

Quality planning for DSN hardware implementation begins with participation by the Quality Engineering and Planning staff in the review and recommendations to the governing Project/task responsibilities, as to the governing requirements documents and associated sub-tier documents. These types of documents generally include:

(1) Hardware Specifications (864-series documents)

(2) Technical Requirements Documents (856-series)

(3) Fabrication/Assembly Drawings (9xxxxxx)

(4) Hardware Test Procedures (869-series documents)

The JPL Quality Assurance Role and Charter for Office 512 defines the areas of Quality Assurance responsibilities and requirements in relation to review of engineering design, drawings, and specifications. Included within this effort is the establishment of quality requirements for subcontractors, JPL in-house activities, and DSN M&O facilities.

2.5.3 Procurement Activity

Quality Assurance supports the implementation of the procurement phase of the DSMS Program/tasks by participation in the following areas of activity:

(1) Establishes quality requirements and implementation, coordinated with the technical cognizant engineer and the cognizant procurement negotiator and executed in accordance with JPL Procurement policies and procedures, which define procurement responsibilities and tasks performed by Quality Assurance.

(2) Participates in Source Evaluation Boards (SEBs) and associated evaluation subcommittees for competitively negotiated major procurements (Note: the participation level is determined by the Management Review Group (MRG)).

(3) Conducts reviews of technical Statements of Work (SOW), Request for Proposals (RFP) and requisitions for inclusion of applicable quality requirements.

(4) Performs surveys in conjunction with Procurement and Engineering to assess a supplier's capability to produce quality work under a qualified Quality System.

(5) Participates in the evaluation of proposals concerning the quality provisions and determines the acceptability of the RFP quality provisions prior to contract award.

(6) Conducts reviews of Contractors' Quality Assurance and Inspection Plans to determine the adequacy of the plans, the extent of JPL inspection required, and their conformance to the JPL RFP requirements.

(7) Reviews purchase orders and contracts to the original quality requirements for consistency with the specifications in applicable RFPs, SOWs, and requisitions issued prior to contract award. All conflicts and/or deficiencies are resolved with the Cognizant Negotiator, Cognizant Engineer, the Project/Task Manager, and/or the Quality Assurance Engineer.

2.6 Surveillance Activities

2.6.1 Implementation Contractors

(1) Responsibilities. Quality Assurance has the responsibility, when invoked by the contractual instrument, to validate that the implementation of the Contractor's Quality System is in accordance with the contractual requirements.

(2) JPL Quality Activity. JPL QA Representatives shall be assigned on a resident or itinerant basis at each contractor facility, depending on the nature of, and as specified in, the contract. The responsibilities and authority of the representatives may include, but are not limited to:

(a) Monitoring and auditing contractor's Quality Assurance activities to ensure compliance with the JPL approved Quality Assurance Plan.

(b) Participating in design reviews for hardware specifications and technical documents.

(c) Establishing and performing JPL mandatory hardware inspections, such as first article, in-process, and pre-shipment inspections at the contractor's facility,

utilizing contractor inspection procedures and instructions approved by JPL.

(d) Monitoring specific inspection and test operations and performing periodic audits for conformance to the contractual instrument.

(e) Participating in the disposition of all nonconforming material and acting as "Government Representative" on all Material Review Boards (MRB).

(f) Performing final inspection at the contractor's facility prior to hardware delivery to JPL.

(g) Verifying the accuracy and completeness of the contractor's end item data package in accordance with the Purchase order/Contract.

(h) Verifying the certifications by the contractor that end items submitted for delivery conform to the Delivery Acceptance Package, applicable specifications, and all other provisions of the contract.

(i) Preparing a JPL Inspection Report (IR) per QAP 141.10, reflecting acceptance of hardware to engineering and quality requirements. Identifying in detail all deviations/exceptions/waivers to the contractual requirements.

2.6.2 Suppliers of Materials, Parts, Equipment, and Services

(1) Requirements. Suppliers of Commercial Off-the-Shelf (COTS) equipment items, parts, materials, and services may be required to develop, maintain, and implement an inspection system compatible with the quality requirements specified in the contractual instrument. The contractor is responsible for implementing the contractual quality requirements with its subcontractors.

(2) Supplier Quality Activity. Quality Assurance shall establish controls and methods for ensuring that JPL-procured articles and services conform to contractual requirements. The inspection operations may include the following areas of quality activity and responsibility, as appropriate to the contract:

(a) Inspection of incoming hardware for compliance to specifications, and/or other documentation specified by the purchase order.

(b) Source surveillance inspection at contractor's facilities supplying hardware or performing special processes; e.g., plating, welding, soldering, documentation, etc.

(c) Disposition of nonconforming hardware.

(d) Maintenance of a system to control the use and accuracy of all equipment, gauges, jigs, and fixtures used for the inspection and acceptance of mechanical hardware at JPL.

(e) Maintenance of a system that provides for a continual assessment of supplier performance.

2.6.3 JPL On-Site Activity

Hardware fabricated at JPL for the DSN shall be subjected to the quality requirements specified herein:

(1) The Cognizant Quality Assurance Supervisor shall coordinate with the cognizant Technical Section (Supervisors or PEMs) to ensure that appropriate quality requirements are implemented for fabrication and assembly of electronic, mechanical, cabling, and hardware to satisfy document 813-125, DSN Hardware Transfer and Delivery Procedures.

(2) The Cognizant Quality Assurance Supervisor shall coordinate with the cognizant Technical Section (Supervisors or PEMs) to ensure that appropriate quality requirements are implemented for software modkits to satisfy document 813-126, DSN Software Transfer and Delivery Procedures.

(3) Appropriate Quality Assurance Procedures shall be implemented to cover on-Lab operations. In some cases (i.e., repairs), procedures shall require concurrence by the Cognizant Technical Engineer.

(4) Hardware for the DSN shall be verified to have been inspected, and tested prior to shipment to the user. Discrepancies shall be documented on IRs in accordance with QAP 141.10.

2.6.4 DSN WA Audit

The effectiveness of the WA program for each DSN Complex shall be audited in accordance with the requirements of the applicable DSN Workmanship Assurance Program Plan. These audits shall be planned by the DSMS QA Representative, and must be coordinated with the DSN Facilities and Logistics Office Manager and the applicable Complex Director (or designated alternate).

2.6.5 Antenna Structures Activity

During implementation of DSN Antenna Subsystem structures, QA responsibilities include (as specified in ES504390), but are not limited to, the following:

(1) Providing on-site inspection resources to implement the quality requirements in contractual documents.

(2) Audit and assistance to contractors in conforming to JPL Quality Assurance requirements and workmanship standards.

(3) Reviews and validation of Contractor Quality Assurance plan implementation.

(4) In-process, alignment, and pre-shipment inspections prior to delivery of equipment to DSN stations.

(5) Inspection of alignments, installations, and modifications at the DSCC facilities.

(6) Providing inspection documentation for inspections performed.

(7) Witness acceptance tests and validates results to the design requirements as required by

the contract, Technical Requirements Document (TRD), or Development and Deployment Plan (DDP).

2.7 Inspection Activities

2.7.1 General

Articles processed, fabricated, and inspected at JPL (including subsystem rework) shall be subject to the controls defined in drawings, specifications, and other applicable technical and quality documents, e.g., Quality Assurance Procedures (QAP) and Quality Assurance Workmanship Standards (QAWS), to provide maximum assurance that the quality inherent in the design is maintained.

2.7.2 Inspection and Test Planning

Documented quality criteria are made available in advance of inspection needs and issued in the form of sub-tier quality instruction documents. These documents, when implemented, define various detailed inspection requirements, actions, activities, and instructions needed to perform specific inspections, such as, but not limited to, hardware component tests, or mechanical/electronic device calibration/maintenance.

2.7.3 Records

Quality Assurance records are stored in the Project Data Management System (PDMS). These records provide evidence of inspections, tests, and material review actions throughout the fabrication and assembly process.

2.8 Non-Conforming Material Control

2.8.1 General

Quality Assurance provides a system, including appropriate records, for the identification, review, disposition, and control of nonconforming material, per QAP 144.2. Basic policies include definitive procedures required for the control of nonconforming material, establishment of the MRB, per QAP 144.1, and the initiation of prompt corrective action to prevent recurrence.

2.8.2 Activity at JPL

(1) Inspection Report (IR). The IR system, in accordance with QAP141.10, is maintained electronically in the Product Data Management System (PDMS). IRs are used to certify that all inspections and tests have been successfully completed and that the hardware is acceptable for shipment or installation into the next assembly. IRs are also used to record results of inspection operations and to document discrepancies for preliminary action. Dispositions are determined as a joint effort by the Technical Division and Quality Assurance Engineer when discrepancies are noted. Dispositions that cannot be mutually determined or agreed upon shall be submitted for MRB action.

(2) Material Review Board Actions. The MRB is utilized when preliminary decisions documented on IRs cannot be mutually agreed upon by the Cognizant Technical Engineer/Supervisor and Quality Assurance Engineer/Supervisor. The MRB consists of the Cognizant Technical Section Manager, Quality Assurance Office Manager, and may also consist of a representative from the Project/task offices. The Quality Assurance Office shall maintain copies of all MRB decisions.

2.8.3 Activity at Contractors

Provisions for establishment of the MRB and for review and disposition of nonconforming hardware are included in the Contractor's Quality Program Plan approved by JPL. The JPL Cognizant Quality Assurance Engineer acts as the "Government Representative" on each MRB. The JPL Cognizant Quality Assurance Engineer is required to obtain the concurrence of the JPL Technical Manager (or his/her designee) before disposition of discrepant items, and approve or disapprove Contractor's MRB dispositions prior to implementation. The Contractor's Quality Assurance personnel are responsible for:

(1) Convening the MRB.

(2) Originating MRB documentation, including identification of defective hardware and the type of discrepancy, MRB dispositions, and actions needed to correct the discrepancies.

(3) Implementing MRB decisions, including effective followup action to preclude recurrence.

2.9 Workmanship Training and Certification

JPL maintains a training program for JPL personnel engaged in fabrication of hardware, assembly, and inspection, where conformance to workmanship standards is necessary or where special processes are critical enough to warrant training.

JPL personnel successfully completing hardware fabrication and assembly courses are issued certificates for demonstration of the proficiency in the related course. JPL Quality Assurance personnel are issued certificates upon completion of inspection courses. All DSCCs have satellite schools that offer selective courses as part of the WA program.

Note: A schedule of courses, details of course content and requirements, and course enrollment are available through the Training and Certification Center (JPL ext 4-6730), or at the following website: https://eis.jpl.nasa.gov/qa/training/

2.10 Workmanship Assurance (WA) Program

The WA program is a supplement to the JPL quality assurance program. This program supports the DSCCs and their support facilities. JPL Workmanship Assurance Interface responsibilities include, but are not limited to the following:

(1) Auditing the WA Program in accordance with the guidelines established in the DSN Workmanship Assurance Program Plan(s).

(2) Auditing inspection tasks and activities at DSN Facilities which have been delegated by the JPL WA Program Office, and which are performed by DSCC Workmanship Assurance personnel.

(3) Providing inspection and documentation records thereof, resulting from the activities specified in GMO-50190-GEN and GMO-50139-GEN.

(4) Auditing compliance with Training and Certification Requirements provided by JPL Quality Assurance and delineated previously in this document.

(5) Generation of WA audit and performance reports and review with DSMS Operations management personnel.

Appendix A
Acronyms and Abbreviations

COT	Commercial Off-the-Shelf
DDP	Development and Deployment Plan
DSCC	Deep Space Communication Complex
DSMS	Deep Space Mission System
DSN	Deep Space Network
ICE	Implementation Coordination Engineer
IR	Inspection Report
JPL	Jet Propulsion Laboratory
M&O	Maintenance and Operations
MRB	Material Review Board
MRG	Management Review Group
PDCR	Preliminary Definition and Cost Review
PDMS	Product Data Management System
PEM	Project Element Manager
QA	Quality Assurance
QAP	Quality Assurance Procedure
QAWS	Quality Assurance Workmanship Standard
RFP	Request for Proposal
SCD	Service Capability Development
SEB	Source Evaluation Board
SOW	Statement of Work
TRD	Technical Requirements Document
WA	Work Agreement
WA	Workmanship Assurance

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